IR Quad Installation and Commissioning + Fitup

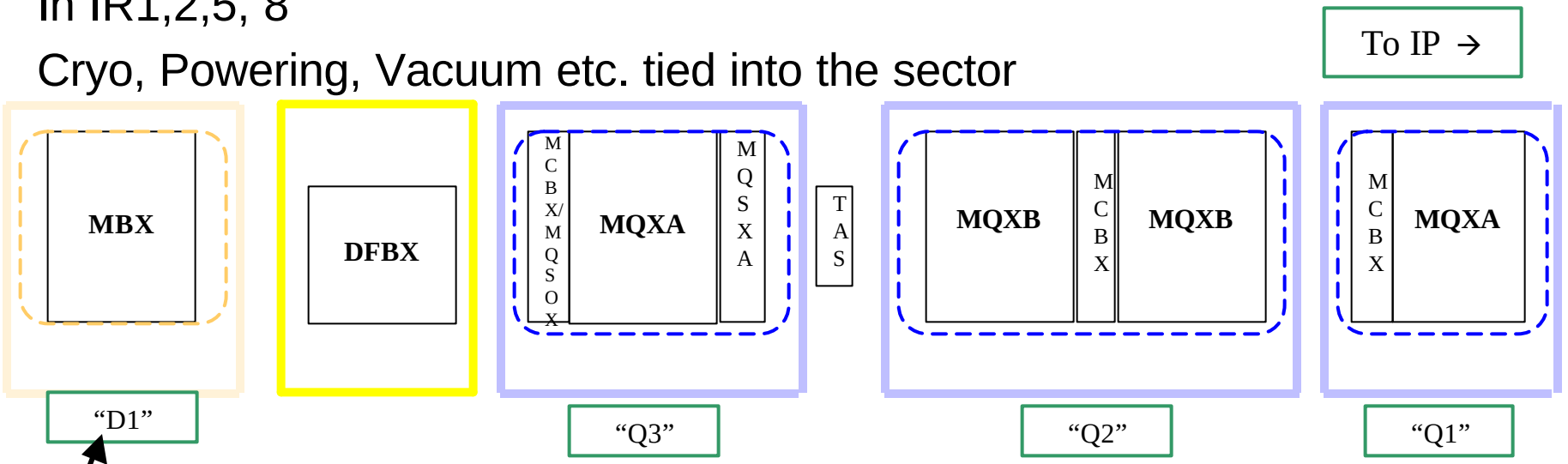
Michael Lamm

7 April 2005

Components to be Commissioned in 5 IR's

In IR1,2,5, 8

Cryo, Powering, Vacuum etc. tied into the sector



IR 2,8 only

Other important components

Hadron and neutral absorber for IR1, 5(LBNL)

Other separation dipoles in IR 1,2,4,5,8 (BNL)

(1) Mechanical Fitup

"Above Ground" Mechanical Fitup

- Inner Triplet (D1,DFBX,Q3-Q1) does not include TAS fitup
- Time Frame: March-May 2005 (approximate duration ~10 weeks)
- Segue into installation of first IR
- Purpose of Test
  - Assemble all pieces for one complete IR
  - Mechanical fitup of interconnects
    - Pipes adjustments to install length, dry fit
    - Vacuum tests
    - Shields, interconnect kits
  - Magnets on alignment jacks
  - Electrical continuity
  - Exercise alignment (SSW?)
  - Build DFBX Cable trays as per final installation

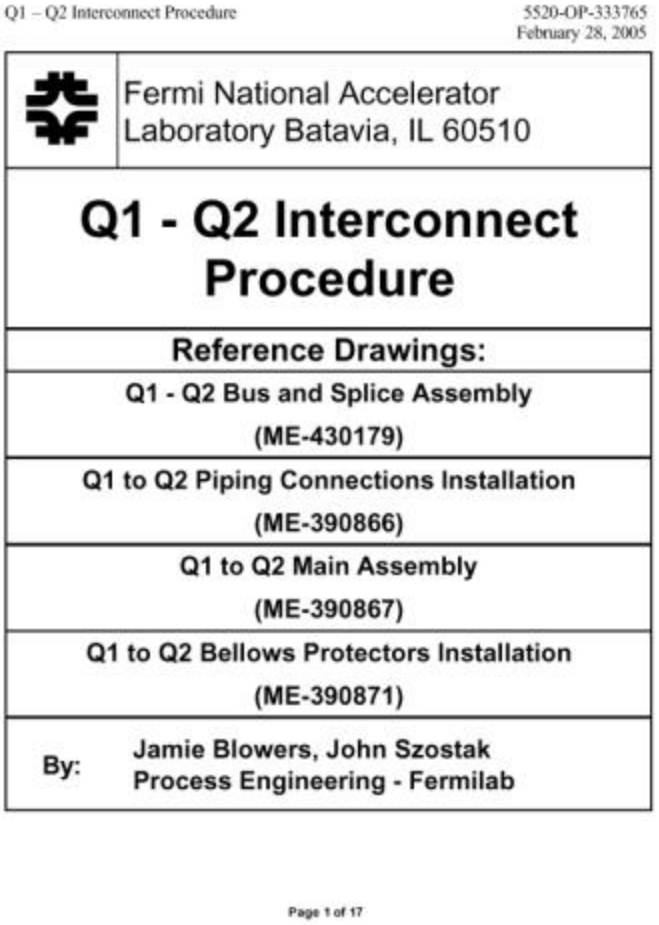
Fitup Preparation

How are have prepared for this:

- Developing detailed plan for interconnect
- Weekly meetings with TD staff, with phone visitors from CERN and other US institutions
  - Minutes http://tdserver1.fnal.gov/lamm/
- 3-D model, drawings, parts list, procedures
- Generating parts and widgets for assembly
- Work with CERN to develop “run plan” for installation

Fitup Preparation

- Documentation of Interconnect
  - Installation Drawings
  - Parts lists
    - CERN supplied
    - US supplied
    - US supplied Tools
  - Procedure for each interconnect
    - Not a Fermilab controlled document
    - Work in progress!



Q1 – Q2 Interconnect Procedure 5520-OP-333765
February 28, 2005

Fermi National Accelerator Laboratory Batavia, IL 60510

Q1 - Q2 Interconnect Procedure

Reference Drawings:

Q1 - Q2 Bus and Splice Assembly (ME-430179)

Q1 to Q2 Piping Connections Installation (ME-390866)

Q1 to Q2 Main Assembly (ME-390867)

Q1 to Q2 Bellows Protectors Installation (ME-390871)

By: Jamie Blowers, John Szostak
Process Engineering - Fermilab

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LHC Assembly Building March 2004

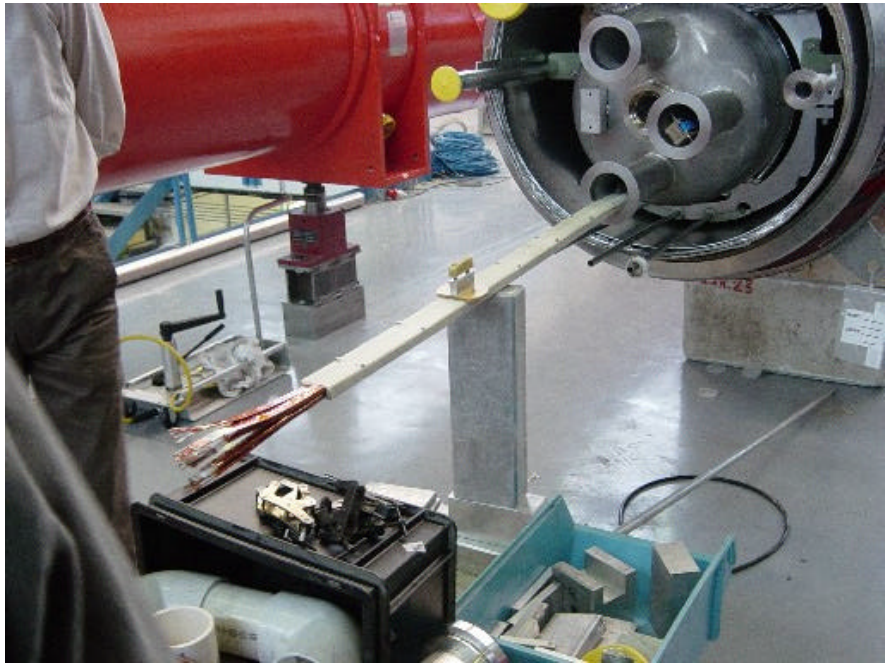
- Inner Triplet
- Alignment Tests of Q2 Element
- DFBX Acceptance

- March 14-March 24th
- Participants: Joseph Rasson (LBNL), Phil Pfund, Tom Page, Tom Nicol, Jim Rife, Michael Lamm (FNAL)
  - –Q1,Q2,Q3, D1 already on magnet stands
  - –Complete Q1-Q2 , Q2-Q3 interconnect
  - –Complete DFBX acceptance tests

Pictures from Fitup

- Jack Stands simulate LSS8 slope
- Installing Heat Exchanger Interconnect

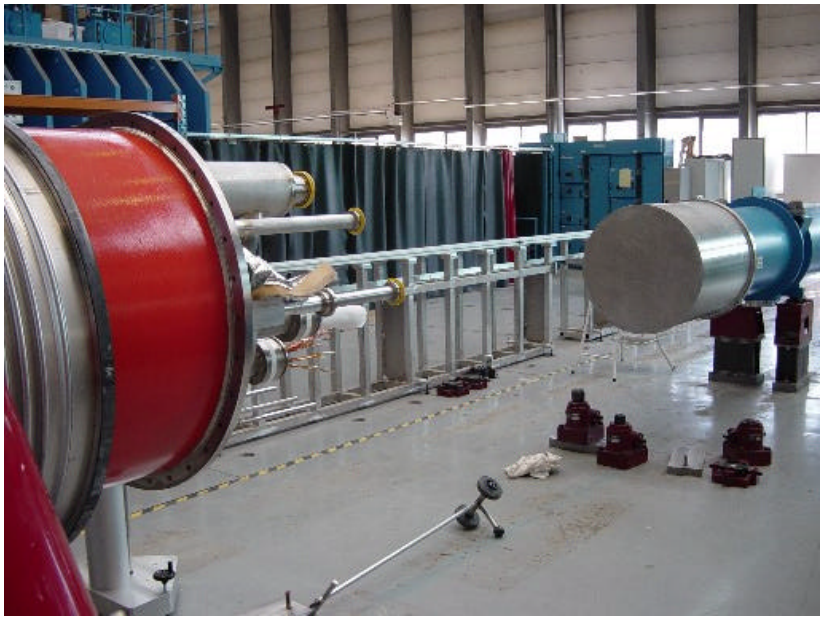
Pictures from Fitup

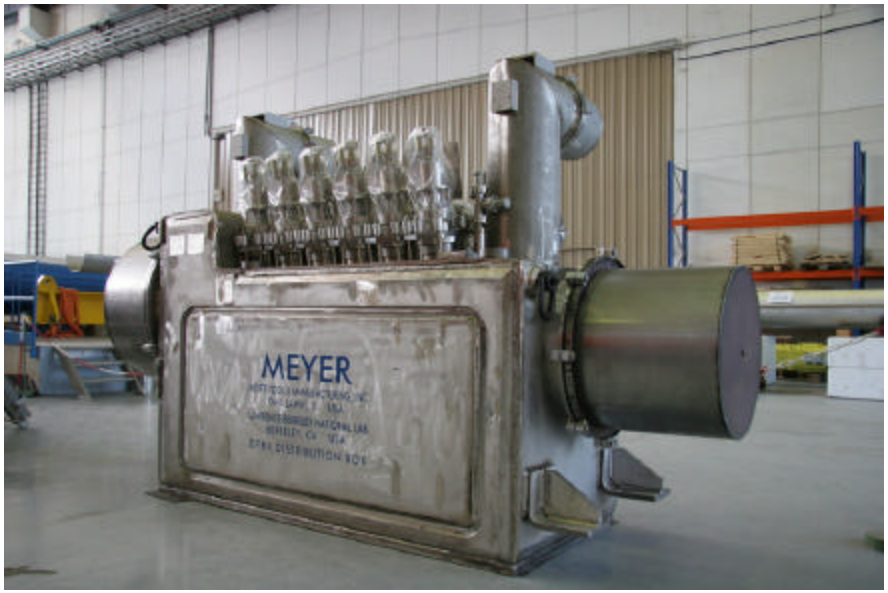


•Bus work housing and spider

•Interconnect piping

Pictures from Fitup





•Space for DFBX

•DFBX

Fitup has been a useful exercise so far…

- Mechancial Interface
  - No (major) problems in interconnect design
  - First draft of procedures, drawings etc. in good shape
  - Interconnect straight forward, but we have probably “low-balled” the effort for US staff
- Electrical interface
  - Have to install bus drift tube on surface
  - Wiring, connectors work well, breakout boxes useful for acceptance
- Feedbox
  - See Joseph Rasson’s talk
  - General comment: DFBX interface to electrical, cryo, power..very busy device.. Each box is unique…acceptance, installation and commissioning will be time consuming. Each box will require participation from LARP HC commissioners.

Extended Fitup Schedule

- April 11-April 22nd
- Participants: Joseph Rasson (LBNL), Phil Pfund, Tom Page, Tom Nicol, Jim Rife, Rodger Bossert, Joe Dimarco, Michael Lamm (FNAL), BNL to supply assembly procedures for D1-DFBX
  - Complete Q3-DFBX , D1-DFBX interconnect
  - Electrical Check of string through DFBX
  - Vacuum Load Test of String
  - Alignment Studies on Q2 element LQXB03
- May
  - Alignment of Inner Triplet
  - Construction of DFBX cable trays
- June
  - Install Beam Screens, BPMs
- July-August
  - Transportation into Tunnel

(2) Installation

- Time Frame: First sector Summer 2005, throughout FY2006, 07?
  - Check mechanical/vacuum/cryo connections
  - Check installation procedures
  - Review electrical and alignment data
  - Installation bugs worked out in Mechanical Fitup
- Level of Effort FY05-6-7
  - ~1/3 FTE on First sector
  - Less on subsequent sectors (but non zero based on fitup)
- Main TD Participants
  - Mechanical Engineers (Rasson, Page, Nicol, Bossert, Plate)
- Main CERN Contacts
  - Ranko Ostojic AT-MEL, Interconnect team in AT-CRI

IR Hardware Commissioning Participants

- We have lined up two people to live at CERN in CY 2006
- Need ~ 1 year lead time for long term move
- Details of long term living have not been resolved and is coupled to global commissioning issues
- Chamonix revelations on aggressive HC schedule inconsistent with previous points
- Therefore: Commissioning participation in Fall 2005 will likely consist of several 2-3 stays by several TD personnel
  - Myself, Tom Peterson, Sandor Feher, Joe Dimarco, Roger Rabehl (FNAL), Rasson (LBNL), Plate(BNL)

Proposed FNAL IR HC Participants in 2006

- Physicist
- Expertise:
  - Quench Analysis & Quench Protection
  - HTS Leads
  - Commissioning Role
    - Quench Protection
    - Commissioning Coordinator
  - Assigned to AT-MEL*
- Cryo engineer
- Expertise:
  - Superfluid cryogenics
  - Inner triplet cryogenics design
  - Commissioning Role
    - Cryogenic Instrumentation
    - Special role in IR cryogenic operation, particularly in first cool down
  - Assigned to AT-ACR*

* Details to be negotiated

Budget and People Resources

- We presented a revised Task Sheet in February 2005 (For IR HC only)
- With breakdown of FTE's/task (I.e. fitup, install, commissioning oversite) /lab
- Need to be refined
  - Fitup task and CERN acceptance is giving us more realistic estimates on installation (estimates were too rosy)
  - Hard to predict what work will occur in each FY
    - Installation in FY05? (probably)
    - How much commissioning in FY06 vs FY07
    - Need to revisit "Big Mac Coefficent" and Exchange rates"
    - What effect does Project Associate Status have on this

Conclusion

- HC is an important way for the US to contribute to the LHC project
  - Inner triplet HC contribution is established
  - Recent new requests in global commissioning could greatly expand our role
- Our participation in Inner Triplet Region is limited by funding and ongoing US commitments
  - We could do more.
- Taking responsibilities in Inner Triplet Region (an area in which the US has a large and unique expertise) will help in the global HC (free up CERN personnel, LARP IR personnel can take on global jobs).
- Major uncertainties are being addressed:
  - Uncertainty in CERN schedule (real schedule now available?)
  - Cost of living in Geneva (tied to CERN project associate?)
  - Lining up the appropriate people at the right time (so far so good)